Smuggling around the World: An Empirical Investigation of Causes and Indicators

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Abstract

Smuggling is a criminal activity which has been a problem around the world. Keeping in line with the issue, the current study explores the causes and indicators of smuggling for developed and developing countries over the time period 1990-2009 by using MIMIC model. This is the first time that any study has made a comparison of smuggling for developed and developing countries. The results indicate that increase in tariff burden intensifies smuggling, whereas unemployment rate and trade openness has a negative effect on smuggling for both sets of countries. Rule of law and corruption leads to increase in smuggling for developing countries while the same have a negative impact on smuggling in case of developed countries. Education leads to a fall in smuggling for developing countries, while unexpectedly, the same stimulates smuggling in developed countries. Turning to indicator, the labor force participation rate is positively affected by smuggling in developed countries and negatively in developing counties. Smuggling could be reduced while giving incentives to work in the official economy and disincentives to operate in the informal economy.

Key Words: Smuggling, Corruption, MIMIC Model, Trade Openness

JEL Classification: C31, H71, K49, F23

1.   Introduction

It is not uncommon for students of international trade to come across the phenomenon of smuggling particularly when their task involves translating the results of theoretical analysis into policy recommendation. Smuggling leads to distortions in international trade data and as a result the policies formulated from it. In the modern times, the causes and consequences of smuggling have gained much attention of academics, policy makers and media. It is important for academics, government authorities and international financial agencies to gather accurate statistics of smuggling in order to

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formulate effective policies to combat this critical issue. This justifies an in depth empirical analysis of smuggling around the world. Nadelmann (1993) argued that the smuggling has been a problem for government authorities and policy makers as regulation failed to resolve the problem of smuggling. Smuggling is not only a challenge to be combated by developing world but also by developed nations. In order to formulate policy for better economic indicators, it is important to know the causes and consequences of smuggling. Thus, this study undertakes this issue and will be helpful in comparing the smuggling phenomena in developed and developing nation.

Until now no study has been done which compares the size of smuggling in developed and developing counties. Studies on individual countries have been taken out, only one study by Buehn and Farzanegan (2008) has been done for the whole world with taking only 55 countries. Their study only calculated the ordinal index of smuggling, and did not calibrate the values into absolute values. The primary objective of our study is to take a further step and does comparative analysis of 183 countries in total by dividing them into 97 developed and 86 developing countries.[2] The other objectives of this study are (a) The determination of causes, issues/implications of smuggling around the world as well as its indicators and, (b) The specification of the best fit model by using the latest econometric techniques to check for the actual determinants and consequences of smuggling.

The rest of the paper is organized as: section 2 presents critical review of the studies conducted over the main theme; section 3 highlights the methods of measuring smuggling and the methodology applied; section 4 consists of selection and justification of variables; discussion of results and interpretation is presented in section 5; and finally section 6 provides conclusions, and the policy implications.

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[2] This table classifies all World Bank member economies and all other economies with populations of more than 30,000. The classification of developed and developing countries has been done by World Bank on the basis of Gross National Income (GNI). For operational and analytical purposes, economies are divided among income groups according to 2010 (GNI) per capita, calculated using the World Bank Atlas method. The groups are: low income, $1,005 or less; lower middle income, $1,006-3,975; upper middle income, $3,976-12,275; and high income, $12,276 or more. We referred low income and lower middle income countries as developing countries. We considered upper middle income and high income countries as developed countries.

2. Literature Review

A large body of literature[3] is devoted to the theoretical aspects of smuggling, only few empirical studies deal with this complex phenomenon. Buehn and Schneider (2011) used Multiple Indicators Multiple Causes (MIMIC) model in collaboration with benchmarking procedure to calculate the size and obtain the absolute values of the shadow economy in 162 countries for the period 1999 to 2007. It is concluded that for all the countries under investigation, the shadow economy touched the size of an un-weighted average value 17.1% of the official GDP, however, the sizes of the shadow economies showed a declining trend over the period. The study could be criticized on the grounds that GDP per capita based on Purchasing Power Parity (PPP) is used only. Why not GDP per capita at current international prices (US dollars)? The trade usually happens at international prices, so it is worthwhile to estimate model with GDP at current international prices (US dollars).

The first and foremost effort to explain smuggling was carried out by Buehn and Farzanegan (2008). They used a Structural Equation Model (SEM) model with a latent variable while taking in to account multiple causal and indicator variables[4] of smuggling simultaneously to obtain the ordinal index of smuggling in 55 countries around the world during 1991-1999. The results showed that there was a negative impact of the lack of corruption index on the latent variable of smuggling. The rule of law index had the negative significant impact on smuggling. The negative link between the trade restriction index and smuggling implies that the fewer trade restrictions are, the lower the level of smuggling will be. Unemployment rate caused a decrease in smuggling. Turning to indicators showed that the smuggling affects BMP positively. The indicator government tax revenue was negatively

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[3]Buehn and Schneider (2011), Alexandru and Dobre (2011), Oladeji (2010), Schneider, Buehn and Montenegro (2010), Dreher and Schneider (2010), Gulzar, Junaid and Haider (2010), Alexandru, Dobre and Ghinarau (2009), Sharapenko (2009), Schneider and Buehn (2009), Dell'Anno and Halicioglu (2009), Dell'Anno and Solomon (2008), Buehn and Schneider (2008), Macias (2008), Dell'Anno (2008), Buehn and Farzanegan (2008), Farzanegan (2008), Schneider (2008), Schneider and Savasan (2007), Dell'Anno (2007), Carolina and Pau (2007), Dell'Anno, Gomez and Pardo (2007), Chaudhuri, Schneider and Chattopadhyay (2006), Arvarte, Lucinda and Schneider (2005), Tedds (2005), Maurin, Sookram and Watson (2004), Bajada and Schneider (2003).

[4] The causes taken for the analysis of smuggling were tariff burden, trade openness, unemployment rate, corruption and rule of law. The indicators of smuggling used were BMP, GDP per capita and tax revenue.

affected by smuggling. This study was the first one to obtain the ordinal index of smuggling around the world. Our study will take a further step forward by investigating smuggling in developed and developing countries by taking into account more causal and indicator variables for a longer period of time from 1990 to 2009. Further, our study will present a comparison of the smuggling in developed and developing countries and provide reasons for the differences in magnitude.

From the literature reviewed it is clear that there are direct approaches, indirect approaches and model approach applied to measure the size of smuggling in individual courtiers and panel of countries as well. What is interesting is that currency demand approach and MIMIC are most widely used ones. MIMIC being the most latest and providing most detailed analysis is considered supreme over currency demand approach.

The previous studies has only done an investigation in of the causes and indicators of smuggling while no study has carried out a comparative analysis of the causes and indicators in the developed and the developing world which provides the basis for the present study. Moreover, the present study takes into account more number of variables as compared to the previous studies done which are education and tax burden as causes and GDP at purchasing power parity, currency ration and labor force participation rate as indicators.

3. Methodology

This section comprises of the methods used to measure smuggling phenomena, their advantages and disadvantages along with a detailed discussion on MIMIC methodology.

3.1. Methods of Measuring Smuggling

It is a challenging task to measure the size of shadow economy. The three useful methods i.e. direct approaches, indirect approaches and MIMIC model approach to measure its size are discussed as below.

3.1.1. Direct Approaches consist of well-designed surveys and samples based on voluntary replies, or tax auditing or other compliance methods (Schneider and Enste, 2004).

3.1.2. Indirect Approaches also known as 'indicator' approaches are mostly macroeconomic which make use of various economic indicators on the development of the shadow economy.[5]

Both direct and indirect approaches estimate the size of the shadow economy by taking into account just one indicator that must capture all effects of the shadow economy. But in reality, the effects of shadow economy appear simultaneously in production, labor and monetary markets which are taken into account by MIMIC modeling.

4. MIMIC Modeling

Keeping in mind the superiority of Structural Equation Modeling (SEM), the present study concentrates on one of the special form of SEM approach i.e., MIMIC model. MIMIC is a special kind of SEM treating the size of the shadow economy as an unobservable 'latent' variable. The latent variable is connected to a set of (observable) indicators reflecting the changes in the size of the shadow economy on one hand and to a collection of (observed) causal variables on the other hand. By using the standard LISREL[6] notation of Joreskog and Sorbom (1993), the specification of the structural equation is shown in equation (1) as below:

$$\eta_t = \gamma x_t + \zeta_t \qquad\qquad 1$$

Equation 1 is a structural equation which shows that the unobserved variable η_t is determined by x_t set of exogenous causes $(x_1, x_2, ..., x_c)$ and ζ_t a structural disturbance error term. Where η_t = unobserved variable; x_t = set of exogenous causes $(x_1, x_2, ..., x_c)$; ζ_t = a structural disturbance error term; and γ = is a $(1 \times c)$ vector of structural parameters. Equation 2 is a measurement equation which is specified as:

$$y_t = \lambda \eta_t + \varepsilon_t \qquad\qquad 2$$

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[5]Currently, there are four indirect indicators in practice as (i) The Discrepancy between National Expenditure and Income Statistics; (ii) The Discrepancy between the Official and Actual Labor Force; (iii) Monetary Methods (The Transactions Approach & The Currency Demand Approach); and (iv) The Physical Input/Electricity Consumption Method (The Kaufmann-Kaliberda Method and The Lack´o Method).

[6] LISREL is an abbreviation of LInear Structural RELations, and the name used by Joreskog for one of the first and most popular SEM programs.

Measurement equation (model) shows the link between the latent variable and its indicators, i.e. the latent unobservable variable is expressed in terms of observed variables. Where, η_t = unobserved or latent variable and it is a scalar; $y^{'} = (y_1, y_2,..., y_d)^{'}$ is a column vector of indicators; ε_t = random error term; and $\lambda =$ is a $(d \times 1)$ column vector of parameters that relates y_t to η_t. Like the MIMIC model's causes, the indicators are directly measurable and expressed as deviations from their mean, i.e. $E(y) = E(\varepsilon) = 0$.

The justification of using MIMIC model is that it takes into account the multiple causes and indicators simultaneously into account while the indirect approach like currency demand approach only considers the causes of smuggling. This way MIMIC is the most comprehensive method to study both the causes of smuggling and its effects on the economic indicators.

5. Selection and Justification of Variables

We have selected the following variables to carry out the analysis. The justification and the explanation for taking these variables for analysis are given below.

5.1. Causes

Katsios (2006) pointed out several reasons and causes for the development of shadow economies, which are listed below.

5.1.1. Tariff Burden*:* Due to high trade restrictions, traders often find illegal ways of trading i.e. smuggling and miss-invoicing. In literature, a positive relationship is observed between tariff burden[7] and smuggling.

5.1.2. Unemployment: The effect of unemployment on the size of the shadow economy can both be positive or negative, Giles and Tedds (2002). Unemployment causes an increase in the number of people working in the black economy which leads to a positive association between the two. Conversely, an increase in the unemployment reduces the size of the illegal economy.[8]

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[7] Studies used tariff rate as proxy for smuggling includes Oskoee and Goswami (2003); Buehn and Farzanegan (2008); and Farzanegan (2008).
[8] See, Dell'Anno, Gomez and Pardo (2007); Dobre and Alexandru (2010); and Dell'Anno (2007).

5.1.3. Rule of Law

Smugglers intend to maximize their net profit (difference between expected revenues and expected costs) from smuggling. The expected cost comprises of penalties on illegal trade. Smuggling becomes less profitable when the difference between expected cost and expected revenues increases. Strong rule of law ensures less chances of smuggling. A negative effect of index of rule of law on the size of smuggling is established in empirical studies.[9]

5.1.4. Corruption

Corruption[10] and shadow economy are perceived as twins which means theoretically they can either be complements or substitutes (Schneider and Buehn, 2009).

5.1.5. Trade Openness

The expected sign of this variable is negative, reason being that opening up the economy reduces the trade restrictions and regulations which in return automatically decreases the size of smuggling (Farzanegan, 2008).

5.1.6. Education

Educated society plays a vital role as an external controller of corruption in the government administration. In literature, a negative relationship is observed between education and corruption (Farzanegan, 2008).[11]

5.1.7. Tax Burden

The most popular and significant cause of the shadow economic activities, as found in literature, is the tax rate. Dell'Anno (2007) states that increase in tax burden acts as a motivation to work in the shadow economy.

5.1.8. Inflation

Cassar (2001) and Macias (2008) pointed out that a higher official inflation rate may lead to substitution effect from official goods towards underground output and wiped out small businesses which developed black market economy.

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[9] See, Kaufmann et al. (2007); Buehn and Farzanegan (2008).

[10] According to Dreher and Schneider (2006), corruption is commonly defined as the misuse of public power for private benefit.

[11] See, Treismann (2000); Ali and Hodan (2003); Alt and David (2003); Rauch and Evan (2000).

5.2. Indicators

It is not possible to measure shadow economy directly. For this purpose, we chose the indicators reflecting the changes in smuggling. The job was to choose the indicators which seem to be most affected by the shadow economy. The most common indicators as employed in various studies are:

(a) **Gross Domestic Product (Variable of Scale):** A control variable which is fixed for the analysis is the GDP. There can either be a negative[12] relationship between smuggling and GDP per capita or a positive[13] relationship. In this study, we fix the coefficient of GDP on the basis of our estimated results.

(b) **Currency:** A basic assumption in most informal sector studies is that to avoid the auditing controls, the irregular transactions are only paid by cash instead of credit. Different currency ratios are used as a proxy for this variable, i.e. M1, M2, M3, etc. Macias (2008) pointed out that an increase in the smuggling is expected to have positive impact on the currency variable.

(c) **Labor Force Participation Rate***:* According to Giles (1998) a decrease in civilian labor force participation rate over time may reflect a switch of the labor force from the official to the unofficial economy. In literature, there is no agreed upon sign of this variable. Following Dobre and Alexandru (2010), we included this variable in our analysis to check whether or not there is flow of resources between the official and the unofficial economy.

(d) **Governmental Tax Revenues***:* Normally, tax revenues are based on the features of the taxation policy and structure of the economy. The proportion of direct taxes is higher in developed economies and on the other side the proportion of indirect taxes is greater in developing economies (Askari, 2006). Smuggling tends to decrease governmental tax revenue.

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[12] Some researchers like Frey and Weck-Hannemann (1984) for 17 OECD countries, Kaufmann and Kaliberda (1996) for Transition countries, Schneider and Enste (2000) for 76 Countries, Dell'Anno (2003) for Italy found a negative relationship.

[13] Adam and Ginsburgh (1985) for Belgium, Giles and Tedds (2002) for Canada, Chatterjee, Chaudhuri and Schneider (2003) for Asian countries, found a positive relation between official and unofficial economy.

(e) Variable of smuggling: Oskoee and Goswami (2003) used the tariff rate as a proxy of smuggling for a cross section of 70 developing countries. Following Buehn and Farzanegan (2008), Farzanegan (2008), we also used tariff rate as the best proxy for smuggling.

5.3. Data Sources

Smuggling which is proxied by tariff rate, tariff burden which is proxied by taxes on international trade, unemployment proxied by unemployment rate, tax burden proxied by governmental tax revenue, trade openness, inflation, GDP purchasing power parity, labor force participation rate, currency M1 and M2 are taken from World Development Indicators (WDI). The index of lack of corruption and rule of law is taken from World Governance Indicators (WGI). Education which is proxied by primary education is taken from World Bank (WB) Education Stats. Currency ratio is found by dividing M1 by M2.

6. Empirical Findings

According to the theoretical considerations about the causes of smuggling, the precise specification of the structural equation in the matrices form is given in equation (3):

$$[Smuggling] = [\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7, \gamma_8] \times \begin{bmatrix} Tariff\ Burden \\ Unemployement\ Rate \\ Rule\ of\ Law \\ Lack\ of\ Corruption \\ Trade\ Openness \\ Education \\ Tax\ Burden \\ Inflation \end{bmatrix} + [\varsigma] \qquad 3$$

The measurement model showing the link between latent variable and its indicators is shown in equation (4):

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$$\begin{bmatrix} GDP\ Purcha\sin g\ Power\ Parity \\ Currency\ Ratio \\ Labor\ Force\ Participation\ Rate \\ Governmental\ Tax\ \mathrm{Re}venue \end{bmatrix} = \begin{bmatrix} -1 \\ \lambda_2 \\ \lambda_3 \\ \lambda_4 \end{bmatrix} \times [Smuggling] + \begin{bmatrix} \xi_1 \\ \xi_2 \\ \xi_3 \\ \xi_4 \end{bmatrix} \qquad 4$$

Following are equation 5 and equation 6 (6a to 6d), the equation form representation of the structural and measurement equation in our model respectively. The structural equation of this specification is given as:

$$\eta = \alpha + \gamma_1 X_1 + \gamma_2 X_2 + \gamma_3 X_3 + \gamma_4 X_4 + \gamma_5 X_5 + \gamma_6 X_6 + \gamma_7 X_7 + \gamma_8 X_8 + \zeta \qquad 5$$

Where, (η) is the variable of smuggling and the causes are tariff burden (X_1), unemployment rate (X_2), rule of law (X_3), lack of corruption (X_4), trade openness (X_5), education (X_6), tax burden (X_7), and inflation (X_8). $\gamma_1, \gamma_2, \gamma_3, \gamma_4, \gamma_5, \gamma_6, \gamma_7, \gamma_8$ are the coefficients attached with $X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8$ respectively. ζ is the disturbance term of the structural equation. The measurement equations linking indicators to the latent variable to smuggling is:

$$Y_1 = \delta_1 + \lambda_1 \eta + \xi_1 \qquad\qquad\qquad 6a$$

$$Y_2 = \delta_2 + \lambda_2 \eta + \xi_2 \qquad\qquad\qquad 6b$$

$$Y_3 = \delta_3 + \lambda_3 \eta + \xi_3 \qquad\qquad\qquad 6c$$

$$Y_4 = \delta_4 + \lambda_4 \eta + \xi_4 \qquad\qquad\qquad 6d$$

The indicators are GDP purchasing power parity (Y_1), currency ratio (Y_2), labor force participation rate (Y_3) and governmental tax revenue (Y_4). $\delta_1, \delta_2, \delta_3, \delta_4$ are the constant terms to the respective indicator's measurement equation with error terms $\xi_1, \xi_2, \xi_3, \xi_4$.

We used three specifications of the model for estimation; Model 1 (8-1-3) with eight causal variables, one variable of smuggling and three indicators; Model 2 (7-1-3) with seven causal variables, one variable of smuggling and three indicators; and Model 3 (6-1-3) with six causes, one variable of smuggling and three indicators. It is interesting to see which variables turn out to be statistically significant especially when we are distinguishing the whole 183 countries' sample into 97 developed and 86 developing countries. Estimated results are provided in table 1 and 2. We first estimated Model 1 but we considered Model 2 and Model 3 to be reported. The reason is that inflation variable has to be deleted from Model 2 and Model 3.[14]

We also used Standardize regression which tells us the relative importance of independent variables on the dependent variable in a model. The main advantage of using standardized regression model is that we can compare the coefficients directly.[15]

6.1.   Result for Total Sample of 183 Countries[16]

The results of all the coefficients of the causes and indicators for Model 2 are reported in the table 1. From the estimated results, we will consider specification 2 i.e. Model 2 for the total sample of 183 countries. The reason being is that it has more variables in accordance with the expected coefficients. All the causal as well as indicator variables have the expected signs. Let's first have a look at the result of causes.

Tariff burden has a positive and statistically significant impact on the growth of smuggling. This means that smuggling increases with the increase in tariff burden. This result is in accordance with Buehn and Farzanegan (2008) and Farzanegan (2008).

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[14] The results of Model 1 are reported in the table 2 in appendix A.

[15] If the coefficient of a standardize regressor is larger than that of another standardize regressor appearing in that model, then the latter contributes more relatively to the explanation of the regressand than the former. The coefficients of standardize regression are provided in appendix B.

[16] The path diagram showing the coefficients of causes and indicators for the total 183 countries is given in figure 1, Appendix C.

Table 1: Results of Coefficients of Model 2 & 3

Country division	Model 2; Specification 7-1-3			Model 3; Specification 6-1-3		
	183 Total	97 Developed	86 Developing	183 Total	97 Developed	86 Developing
Causal Variables						
Tariff Burden	0.363 (0.000)*	0.433 (0.000)*	0.039 (0.747)	0.361 (0.000)	0.433 (0.000)	0.058 (0.616)
Unemployment Rate	0.026 (0.626)	-0.024 (0.603)	-0.085 (0.732)	0.033 (0.537)	-0.021 (0.647)	-0.116 (0.629)
Rule of Law	-1.506 (0.137)	-4.276 (0.000)*	14.341 (0.000)	-1.467 (0.147)	-4.252 (0.000)	14.025 (0.000)*
Lack of Corruption	0.21 (0.818)	1.900 (0.018)*	-7.107 (0.010)	0.245 (0.793)	1.909 (0.018)	-7.216 (0.008)*
Trade Openness	-0.019 (0.000)*	-0.010 (0.017)*	-0.074 (0.010)	-0.019 (0.000)	-0.010 (0.017)	-0.079 (0.003)*
Education	-0.073 (0.183)	0.181 (0.016)*	-0.171 (0.044)	-0.069 (0.203)	0.186 (0.012)	-0.171 (0.043)**
Tax Burden	0.029 (0.525)	0.017 (0.648)	-0.106 (0.622)	---	---	---
Inflation	---	---	---	---	---	---
Indicator Variables						
GDP Purchasing Power Parity	-1	-1	+1	-1	-1	+1
Currency Ratio (M1/M2)	0.008 (0.000)*	0.006 (0.004)*	-0.002 (0.472)	0.008 (0.000)	0.006 (0.004)	---
Labor Force Participation Rate	0.465 (0.000)*	0.203 (0.020)*	-0.281 (0.065)	0.482 (0.000)	0.210 (0.016)	-0.300 (0.049)**
Governmental Tax Revenue	---	---	---	---	---	-0.049 (0.476)
Statistical Tests						
R^2	0.319	0.488	0.451	0.318	0.488	0.449
Adjusted-R^2	0.304	0.474	0.395	0.305	0.476	0.402

S.E of Regression	5.119	3.918	5.859	5.115	3.912	5.827
F-statistic Prob (F-statistic)	21.911 (0.000)	34.155 (0.000)	8.10 (0.000)	25.542 (0.000)	39.939 (0.000)	9.520 (0.000)
Instrument Rank	8.000	8.000	8.000	7.000	7.000	7.000

P Values are given in parenthesis; * shows significance at 1%, ** at 5%, and *** at 10%.

Trade openness negatively effects smuggling. The results are in line with the hypothesis that trade openness has a negative effect on smuggling.[17] The findings also support the results of a positive effect of tariff burden on smuggling which means as tariff burden decreases, trade openness increases, leading to a fall in smuggling. According to estimations, a rise in education leads to a fall in smuggling activities. The hypothesis that education decreases smuggling is accepted. Similarly, Farzanegan (2008) also found a negative relationship between education and smuggling. The results reveal that smuggling decreases with an increase in education as the educated lot perceive smuggling not only illegal but also immoral. Moreover, the educated lot is better employed, reducing their chances of being involved in smuggling. Tax burden is found to have a positive effect on smuggling. As the tax burden increase, it will put burden on the businessmen and they will move towards smuggling. Most of the studies done on the hidden economy found tax burden as a major contributor to the shadow economy.[18]

Turning to the indicators, we come to know that smuggling increases currency ratio thus we accept the hypothesis that smuggling leads to an increase in the cash holdings.[19] The use of the amount of money in the form of cash is a fair indicator of the changes in the size of the smuggling. The indicator of labor force participation is significant and positively affected by smuggling. There is evidence present that much unrecorded economy activity is undertaken by members of the measured workforce (Dell'Anno, Gomez and Pardo, 2004). We fixed the indicator of GDP purchasing power parity to -1.

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[17] Similar results were found by Farzanegan (2008), Schneider, Buehn and Montenegro (2010), Buehn and Schneider (2011), Buehn and Farzenagan (2008), Schneider and Buehn (2009), Gulzar, Junaid and Haider (2010).

[18] Check Cebula (1997), Johnson et al. (1998), Schneider and Enste (2000), Savasan (2003).

[19] All other things being equal, more cash holdings reflect more smuggling. A positive sign is established between smuggling and currency ratio in studies by Dell'Anno, Gomez and Pardo (2007).

6.2.   Result for Sample of 97 Developed Countries[20]

Here once again we choose Model 2 considering that it reports more significant variables along with the expected signs. The results are reported in table 1. Tariff burden leads to an increase in smuggling and increase in unemployment rate leads to a fall in smuggling[21] (coefficient is -0.024). This is because unemployment has a negative relationship with the growth of official economy (Okun's law) and illegal economy is likely to increase with the growth in the official economy (Buehn and Farzanegan, 2008).

Rule of law has a negative effect on smuggling. This effect turns out to be highly statistically significant at 1%. Lack of corruption again has a statistically significant positive effect on smuggling.[22] This result must be seen in collaboration with the surprising result of education. Shockingly, education turns out to be positively impacting smuggling. The reason may be that educated people may devise more ways of dodging the authorities and carry out smuggling without being caught or inspected. Trade Openness causes a fall in smuggling activity. This is found to be statistically significant. Tax burden positively effects smuggling but it is found to be statistically insignificant effect.[23]

Turning to the indicators results, we come to know that smuggling leads to an increase in currency ratio. This effect is also highly statistically significant. This is in accordance with the results found in literature. Smuggling also has a positive effect on the labor force participation rate.

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[20] The path diagram showing the coefficients of causes and indicators for 97 developed countries is given in figure 2, Appendix C.

[21] Macias (2008), Buehn and Farzanegan (2008), Schneider, Buehn and Montenegro (2010), Buehn and Schneider (2011), Buehn and Schneider (2008), Pickhardt and Sarda (2006), Gulzar, Junaid and Haider (2010) found negative effect of unemployment on smuggling.

[22] The reason can be that the traders are well educated and know different ways to cheat the authorities through under invoicing and over invoicing thus we accept the hypothesis that corruption and smuggling are substitutes.

[23] Other studies which also found positive effect of tax burden are Schneider, Buehn and Montenegro (2010), Buehn and Schneider (2011), Dell'Anno (2007), Schneider and Buehn (2009), Schneider, Chaudhuri and Chatterjee (2003), Dell'Anno, Gomez and Pardo (2007), Schneider and Savasan (2007), Sharapenko (2009).

6.3. Result for Sample of 86 Developing Countries[24]

Finally, consider the results of 86 developing countries over the period 1990-2009. For the developing countries we considered Model 3. We excluded tax burden from the causes for 86 developing countries as we are now taking governmental tax revenue as an indicator. The other indicators used are GDP purchasing power parity, and labor force participation rate. We excluded indicator of currency ratio from this specification as it gave a theoretically wrong sign. This is also a reason of including governmental tax revenue as a third indicator in the model. The results of all the coefficients of the causes and indicators for Model 3 are reported in the table 1.

Tariff burden has a positive effect on smuggling but the effect is found to be statistically insignificant in case of developing countries. Unemployment rate has a negative statistically insignificant effect on smuggling. Rule of law has a positive statistically significant effect on smuggling. This is rather new result and the reason can be that law enforcing agencies might be corrupt and help in smuggling also. This is proven by the statistically significant negative effect of the lack of corruption variable. Though, rules are there in documentation but the will to implement them is missing by the corrupt authorities. Since rules are not followed, people perceive that such are meaningless which give rise corruption and thus smuggling takes place making developing countries heaven for smugglers.[25]

The lack of corruption has a statistically significant negative effect on smuggling in the developing countries. In low income countries the enterprise completely engages in the underground economy[26] instead of working partially in official sector and partially in unofficial sector as in case of high income countries. In such case, corruption and smuggling reinforce each other, as corruption expands the smuggling activities and at the same time smuggling requires both corruption and bribes. Therefore, a positive[27] (complementary) link between corruption and smuggling is established in low

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[24] The path diagram showing the coefficients of causes and indicators for 86 developing countries is given in figure 3, Appendix C.

[25]Oladeji (2010) found that the people of the area studied in Nigeria, views law enforcement agents as aiding and assisting the smugglers.

[26] See, e.g., Gerxhani (2003), Johnson et al. (1997), and Schneider (2005).

[27] Johnson et al. (1997) found a positive impact of corruption on the shadow economy and a negative impact on the official economy.

income countries.[28]Trade openness has a negative statistically significant effect on smuggling. It means smuggling decreases with the liberalization of economy. Education as expected leads to a fall in smuggling and the effect of education on smuggling is found to be statistically significant as well.

Taking into account of indicators of smuggling, we see that smuggling has a statistically significant negative effect on labor force participation rate. Other things being equal, the changes in the labor force participation rate may reflect a flow of resources between the official to the unofficial economy. The reason for this negative effect is that infant industries cannot compete with the smuggled goods which lead to decrease in employment. This leads to fall in labor force participation rate. A negative sign would mean that there is a flow of worker from official to shadow economy (Dell'Anno, Gomez and Pardo, 2007).

The effect of smuggling on governmental tax revenue is negative. The results are in line with the hypothesis that a rise in smuggling leads to a fall in the revenue of government.[29] Smugglers evade tariffs and legal duties, putting an extra burden on a government's budget which reduces the provision of public goods by the government (especially in developing countries). Therefore, the foreign trade tax revenues of the central government falls with an increase in the smuggling activity, ceteris paribus.

6.4. The Comparison of Smuggling in Developed and Developing Countries

First, we will compare the effect of causes on smuggling. Tariff burden has the positive sign in both developed and developing countries. Unemployment rate has the expected negative sign for both sets of countries. Rule of law has a negative impact on smuggling as for developed countries but in developing countries, rule of law has a positive effect on smuggling. This is such a major difference and the reason can be that since it is perception index, people in the developed countries perceive that rule of law leads to fall in smuggling. In case of developing countries tough rules are there but they lack implementation. Hence people take rule of law in their hands or dodge the regulatory authorities to carry out smuggling. Lack of corruption has a positive statistically significant effect on smuggling in case of developed

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[28] This is in line with the calculations of the models of Hindriks et al. (1999), Johnson et al. (1997) and Hibbs and Piculescu (2005), Dreher and Schneider, (2010), Schneider and Buehn, (2009).

[29] This is in line with the findings of Farzanegan (2008), Buehn and Farzanegan (2008).

countries, while it has the expected negative statistically significant effect on smuggling in case of developing countries. Trade openness has negative effect on smuggling in both developed and developing countries. It means that in both developed and developing countries, smuggling reduces with the liberalization of the economy. Education, unexpectedly leads to a rise in smuggling in case of developed countries and it causes a fall in smuggling in developing countries.

Comparing the indicator results, we come to know that labor force participation rate is positively affected by smuggling in developed countries. In case of developing countries, the labor force participation rate is negatively affected by smuggling. We checked the relationship between unofficial and official economy in order to fix the value of GDP purchasing power parity. We observed a negative relationship between smuggling and GDP in case of developed counties; hence we fix the value of GDP purchasing power parity to -1. We observed a positive relationship between smuggling and GDP in case of developing countries. For this reason, we fixed the value of GDP purchasing power parity to +1 in case of developing countries.

7.   Conclusion and Policy Implications

We made an attempt to estimate the causes and effects of smuggling around the world over the period 1990-2009. We have estimated the smuggling phenomena in 183 countries in total. This is a contribution as this much huge amount of data set has never been studies by researchers' uptil now. NO research has been carried out which estimated the smuggling phenomena in developed and developing countries. Another contribution we made is the comparison of smuggling in developed and developing countries. This is the first time that any researcher has made a comparison of smuggling in developed and developing countries. Summarizing all, we note that tariff burden and tax burden led to an increase in smuggling. Unemployment had both a positive and negative effect on smuggling. Rule of law, trade openness and education led to fall in smuggling. Corruption was found to have a substitution effect on smuggling in developed countries and a complementary effect on smuggling in developing counties. Smuggling led to an increase in cash holdings. Smuggling had a positive effect on labor force participation rate in developed counties and a negative effect in case of developing countries. Governmental tax revenue decreased as a result of an increase in smuggling. The results of the present research will be helpful in formulating policies to fight back smuggling.

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In our view, reduction of smuggling is a difficult process but it can be achieved with a mixture of coordinated economic policies (Dell'Anno and Piirisild, 2007). Based on the results of our study, we can argue that smuggling is sensitive to policy changes to a great extent. It is proposed that the government should commit itself to long term planning. Moreover, the government should ensure political stability, devise a detailed package to curb corruption and ensure rule of law.

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Appendix – A
Table 2: Results of Coefficients of Model 1

Country division	Model 1; Specification 8-1-3		
	183 Total	97 Developed	86 Developing
Causal Variables			
Tariff Burden	0.363 (0.000)	0.434 (0.000)	0.038 (0.758)
Unemployment Rate	0.024 (0.657)	-0.028 (0.544)	-0.088 (0.729)
Rule of Law	-1.517 (0.134)	-4.272 (0.000)	14.309 (0.000)
Lack of Corruption	0.068 (0.942)	1.776 (0.030)	-7.123 (0.010)
Trade Openness	-0.019 (0.000)	-0.010 (0.016)	-0.073 (0.013)
Education	-0.071 (0.194)	0.177 (0.018)	-0.171 (0.045)
Tax Burden	0.031 (0.503)	0.018 (0.633)	-0.107 (0.622)
Inflation	-0.042 (0.254)	-0.026 (0.383)	-0.012 (0.926)
Indicator Variables			
GDP Purchasing Power Parity	-1	-1	+1
Currency Ratio (M1/M2)	0.008 (0.000)	0.005 (0.006)	-0.002 (0.472)
Labor Force Participation Rate	0.461 (0.000)	0.203 (0.020)	-0.281 (0.065)
Statistical Tests			
R^2	0.322	0.490	0.451

Adjusted-R^2	0.305	0.474	0.386
S.E of Regression	5.117	3.920	5.901
F-statistic Prob (F-statistic)	19.353 (0.000)	29.95 (0.000)	6.993 (0.000)
Instrument Rank	9.000	9.000	9.000

P Values are given in parenthesis; * shows significance at 1%, ** at 5%, and *** at 10%.

Appendix – B

Standardized Parameter Estimates for Models

Specification	Model 2 Specification 7-1-3		Model 3 Specification 6-1-3
Causes	**Total 183 Countries**	**97 Developed Countries**	**86 Developing Countries**
Tariff Burden	0.221 (3)	0.226 (3)	0.042 (5)
Unemployment Rate	0.030 (5)	0.025 (5)	0.120 (3)
Rule of Law	12.210 (1)	29.630 (1)	214.475 (1)
Lack of Corruption	1.715 (2)	12.095 (2)	135.849 (2)
Trade Openness	0.003 (7)	0.001 (7)	0.019 (6)
Education	0.034 (4)	0.192 (4)	0.076 (4)
Tax Burden	0.029 (6)	0.014 (6)	---

The ranking of the standardized coefficients is given in parenthesis where (1) reveals most important cause and (7) shows the least important cause of smuggling for Model 2 in Total 183 Countries and 97 Developed Countries and Model 3 for 86 Developing Countries.

Smuggling around the World: An Empirical Investigation of Causes and Indicators

Appendix – C

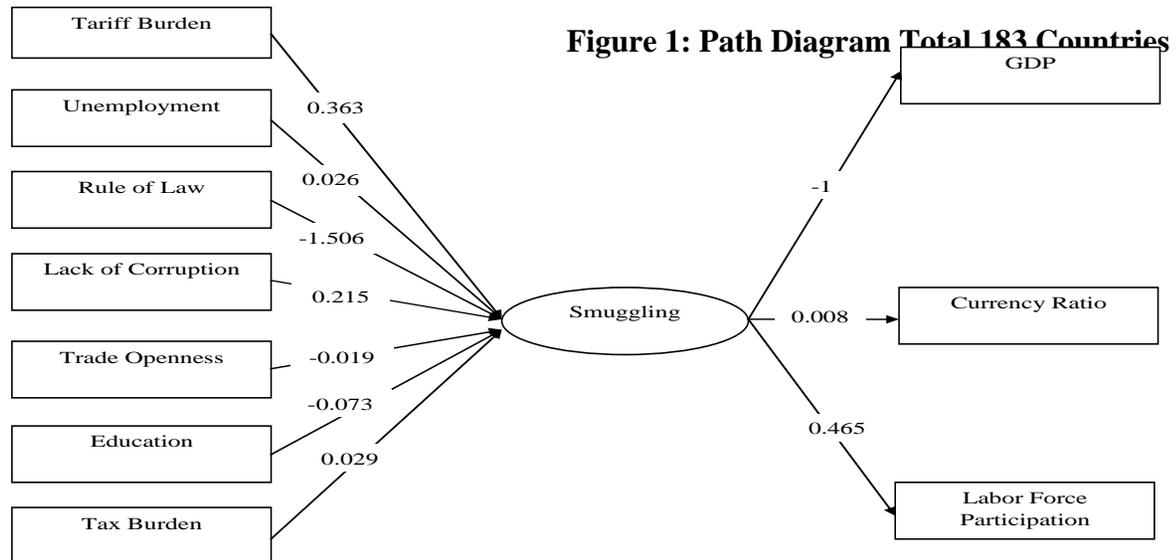**Figure 1: Path Diagram Total 183 Countries**
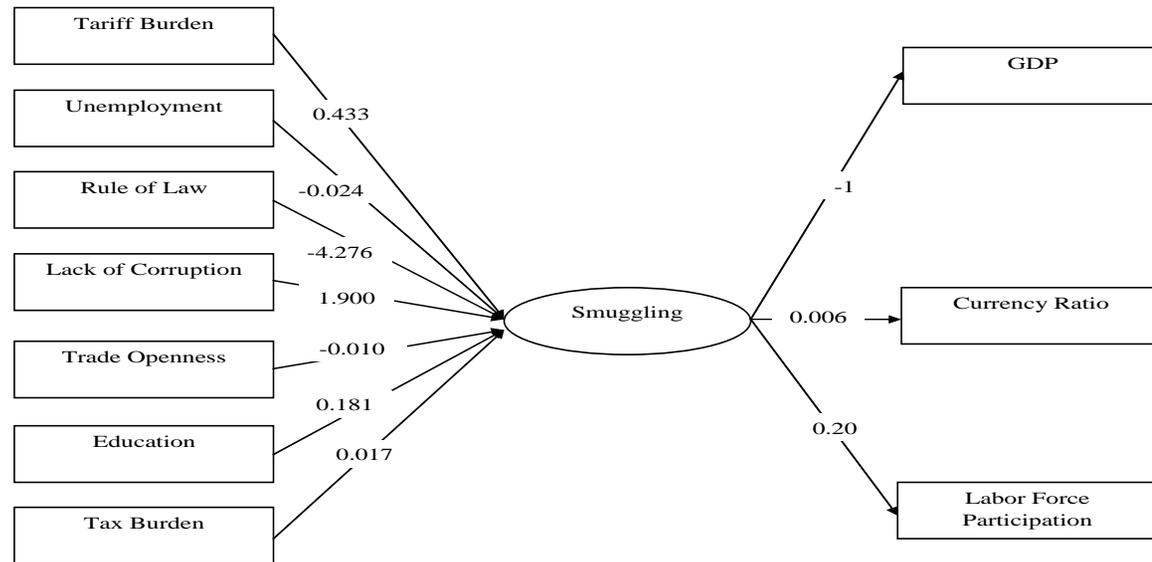

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Figure 2: Path Diagram for 97 Developed Countries

Figure 3: Path Diagram for 86 Developing Countries